long as a portion of the perimeter of the tube is covered with water there is no danger of the tube becoming overheated. The hydrostatic head causing the flow of water into the tube will be due to any difference of temperature between the front and rear tube headers and the height of the water column above the tube. Some experiments have indicated that this velocity decreases as .the boiler is forced above rating. Should the flow of water be interrupted it will only require a few seconds for the tube to become full of dry steam, it would then rapidly heat until it burst. This would throw full boiler pressure against any slight obstruction and immediately remove all evidence of the cause of the trouble. With tube pitches of less than that assumed, the liability to interruption in the water circulation increases. The slight differential head that exists through a tube might readily oe sufficient to hold a piece of loose scale over the end of a tube and be insufficient to break it; that is, a very slight obstacle would suffice to stop the flow of water or so reduce it that a considerable portion of the tube surface would become dry. Another possible cause of burst tubes is the forcing of the boiler to such an extent that the water inflow into a tube becomes insufficient to provide for the evaporation taking place. This last condition would be more likely to occur in a clean tube, free from scale internally and from dust externally, than in a dirty tube.

When the boiler tubes are vertical or nearly vertical the water circulation is enhanced by the " air-lift effect " of the steam bubbles. Like the air lift, this is a problem that involves so many uncontrollable variables that it is doubtful whether any rational expression for this circulation will ever be worked out. The investigation of this circulation, however, will throw con-

siderable light upon the rational design of steam boilers. It is very possible that a modification of the design of the Niclausse boiler, having the field tubes set vertically with the manifold at the top, will offer almost unlimited forcing possibilities, greatly exceeding the evaporative capacity of existing designs. To secure increased circulation in any design it is rather important that the course of the water and the steam bubbles should be arranged in such a manner that they do not impede each other. Theoretically, there should be no limitation to the amount of forcing which a vertical-tube boiler can stand except the heat-absorption capacity of its heating surface. With inclined tubes the boiler can be